

MISSOURI STREAM TEAM GUIDE TO

# AQUATIC MACROINVERTEBRATES



*Cover photo by Chris Lukhaup*



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Caddisfly larva

## AQUATIC MACROINVERTEBRATES

are animals that live in water, are visible to the naked eye, and lack a backbone. They are good indicators of water quality because they are permanent residents of streams and can move only short distances. This makes them vulnerable to pollutants that may be in the water.

Some pollutants pulse through streams. Pulses may be caused by periodic discharges of pollutants, variations in stream flow caused by rainfall, or other factors. The macroinvertebrate community in a stream reflects both intermittent and long-term water quality impairments in a way that the "snapshot" approach of chemical sampling cannot.

Different species of macroinvertebrates tolerate different levels of pollution. Some species are pollution sensitive, others are somewhat pollution tolerant, and still others are pollution tolerant. Healthy streams support a diverse macroinvertebrate community, including species in each pollution tolerance category. Degraded streams are dominated by pollution tolerant species.



# Caddisfly

*Trichoptera*

**Identifying characteristics:** (Larva) Body is longer than it is wide; distinct head; one to three hard plates on thorax; abdomen ends in two terminal hooks and, unlike thorax, has no hardened outer plates

**Habitat:** Many caddisfly species construct homes using various materials found in streams (leaves, twigs, sand, etc.). The home is distinctive for each species. Other species live between rocks where they spin a silken net to catch food.

**Food source:** Most caddisflies are filterers, scrapers, collectors, and shredders, feeding on plant foods. Some, however, are predators and eat insects. Predator species usually do not build homes.

**Interesting fact:** If pollution in the stream is too high, some net-spinning caddisflies cannot spin their nets to catch food.



# Hellgrammite/Dobsonfly

*Megaloptera*

**Identifying characteristics:** (Larva) Up to 4 inches long, hairlike gills under abdominal lateral filaments that look like dirty cotton, large mandibles

**Habitat:** Hellgrammutes live in fast-flowing water under large rocks and woody debris.

**Food source:** Larvae are active predators, feeding on other small aquatic insects or even small fish.

**Interesting fact:** Hellgrammutes are used by anglers as bait for smallmouth bass.



# Mayfly

*Ephemeroptera*

POLLUTION SENSITIVE

**Identifying characteristics:** (Nymph) Feathery or platelike gills on abdomen, legs end in one hook, usually three tails

**Habitat:** Nymphs generally spend their time under rocks.

**Food source:** Mayfly nymphs are scrapers and collectors, feeding on small plants or algae. As adults, mayflies do not have functioning mouthparts and cannot eat.

**Interesting fact:** Anglers copy mayfly colors and sizes when tying flies for fly fishing.



# Gilled Snail

*Gastropoda*

**Identifying characteristics:** (Adult) With the spiral pointing up and the opening (aperture) facing up, the shell opens to the right. Do not count empty shells.

**Habitat:** Gilled snails are found in a variety of shallow-water habitats.

**Food source:** Gilled snails are primarily scrapers, feeding on algae, dead leaves, and other plant materials.

**Interesting fact:** As the name implies, this snail uses gills to breathe.



Adult



Larva

# Riffle Beetle

*Coleoptera*

**Identifying characteristics:** (Adult) Tiny, six-legged beetle; crawls slowly on the bottom. (Larva) Entire length of body covered with hard plates, six legs on thorax, uniform brown color. Combine number of adults and larva when reporting total counts.

**Habitat:** Riffle beetles generally live clinging to rocks in fast-flowing water. Some may be found in crevices or under decaying, woody debris in slower-moving water.

**Food source:** Adults and larvae are collectors and scrapers, feeding on algae and microscopic organisms attached to rocks and plants.

**Interesting fact:** Adults may not resurface for air in well-oxygenated water.



# Stonefly

*Plecoptera*

**Identifying characteristics:** (Nymph) No gills on the abdomen, sometimes have hairlike gills under the legs on the thorax (hairy armpits), two tails

**Habitat:** Stoneflies live in flowing water among rocks and gravel.

**Food source:** Nymphs are primarily predators, collectors, and shredders that feed on other insects or bacteria and fungi.

**Interesting fact:** Adults tap (drum) their abdomens on twigs or branches to attract mates.



# Water Penny

*Coleoptera*

**Identifying characteristics:** (Larva) Flat and copper-colored like a penny; shaped like a small, upside-down saucer; segmented, hard plate conceals head and legs from above

**Habitat:** Water pennies are found stuck to rocks in fast-flowing water.

**Food source:** Larvae are primarily scrapers, feeding on algae, plants, and microscopic organisms that are attached to rocks.

**Interesting fact:** Adults are not aquatic. Larvae are some of the most distinctive of aquatic insects.



# Other Aquatic Beetles

*Coleoptera*

**Identifying characteristics:** (Larva) A diverse group, six distinct legs, obvious mouthparts

**Habitat:** Beetle larvae may be found in a variety of aquatic and semi-aquatic habitats. Depending upon the species, they can be found in or on the substrate, or on aquatic plants.

**Food source:** Most species are predators, feeding on other aquatic insects. Some species inject or apply a fluid (venom or digestive fluid) with their mouthparts.

**Interesting fact:** Some beetle species enter and leave the water at will.



# Clams and Mussels

*Bivalvia*

SOMEWHAT TOLERANT

**Identifying characteristics:** (Adult) Two-piece (bivalve) shell with two opposing valves connected by a hinge, size ranges from  $\frac{1}{16}$  inch to 10 inches

**Habitat:** Clams and mussels occur in a variety of aquatic habitats, either on or in the substrate.

**Food Source:** Bivalves are primarily filter feeders, straining plankton and other microorganisms from the water.

**Interesting fact:** Mussels were once harvested for their pearls, while the shells were harvested for buttons.



# Crane Fly

*Diptera*

**Identifying characteristics:** (Larva) Up to 4 inches long; caterpillarlike; may have enlarged lobe or fleshy, fingerlike extensions at the end of abdomen

**Habitat:** Crane flies are generally found in shallow stream areas in well-oxygenated water. They often burrow into silt, sand, gravel, or woody debris.

**Food source:** Most larvae are omnivores, feeding on algae, plants, and microscopic organisms attached to rocks. Predatory species feed on other aquatic insects, such as midge fly larvae.

**Interesting fact:** Crane flies are sometimes sold in Midwestern bait shops for bass fishing and are called "spikes."



# Crayfish

*Decapoda*

SOMEWHAT TOLERANT

**Identifying characteristics:** (Adult) Body protected by hard plates; ten legs (first three pairs are pincerlike at their ends, first pair large); resembles a small lobster

**Habitat:** Crayfish are found in a variety of shallow-water habitats. During the day, they remain hidden in burrows or under stones and debris.

**Food source:** Most species are primarily collectors that feed on aquatic insects and other animals, but they also are known to feed on plant materials.

**Interesting fact:** Crayfish are often used as bait by anglers, and edible species are harvested for human consumption. Crayfish can regenerate lost appendages.



# Dragonfly

*Odonata, Suborder: Anisoptera*

**Identifying characteristics:** (Nymph) Wide, oval-to-round abdomen, which is often flattened and leaflike; large eyes; masklike lower lip

**Habitat:** Dragonflies inhabit a variety of aquatic environments, including ponds, lake margins, and shallow areas of streams.

**Food source:** Dragonflies are almost exclusively predators, feeding on other aquatic insects. Prey movements attract them.

**Interesting fact:** Nymphs may be propelled or aided in their forward locomotion by a forceful expulsion of water from a chamber in the abdomen.



# Damselfly

*Odonata, Suborder: Zygoptera*

**Identifying characteristics:** (Nymph) Slender body; six legs; three broad, oar-shaped tails that position like a tripod when in water

**Habitat:** Damselflies inhabit a variety of aquatic environments, including ponds, lake margins, and shallow areas of streams.

**Food source:** Damselflies are almost exclusively predators, feeding on other aquatic insects. Prey movements attract them.

**Interesting fact:** Like dragonflies, adult damselflies are commonly referred to as "mosquito hawks."



# Scud

*Amphipoda*

**Identifying characteristics:** (Adult) Generally white to gray in color, moves quickly, swims sideways, many appendages on abdomen, many think it resembles a shrimp

**Habitat:** Scuds occur primarily in shallow water of all kinds, often among vegetation and debris.

**Food source:** Scuds are primarily collectors, feeding on dead leaves and other plant materials.

**Interesting fact:** Scuds are an important food source for many fishes. Several fly patterns for nymph fishing are based on scuds.



# Sowbug

*Isopoda*

SOMEWHAT TOLERANT

**Identifying characteristics:** (Adult) Generally gray; oblong body, wider than it is high; seven pairs of legs; long antennae; looks similar to a roly-poly bug

**Habitat:** Sowbugs are found in a variety of shallow water habitats, usually among rocks and leaf detritus.

**Food source:** Most species are collectors, feeding on dead leaves and other plant materials.

**Interesting fact:** Some species can occur in large numbers in certain areas of streams.



# Fishfly

*Megaloptera*

**Identifying characteristics:** (Larva) Lateral filaments, looks like a small hellgrammite but has no gills under its lateral filaments

**Habitat:** Fishflies are generally found in well-oxygenated, flowing water, under bark or decaying wood.

**Food source:** Fishflies are almost exclusively predators, eating other aquatic insects.

**Interesting fact:** The larvae of some species obtain oxygen from the air using a pair of elongated breathing tubes.



# Alderfly

*Megaloptera*

**Identifying characteristics:** (Larva) Lateral filaments with no visible gill tufts; one long, hairlike tail at end of abdomen; tail resembles the capital letter "A" at the base

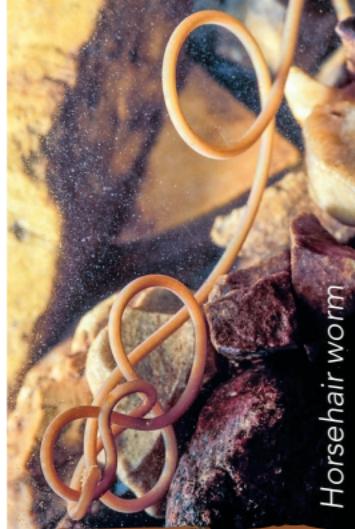
**Habitat:** Alderflies can be found in quiet water among detritus or rocks.

**Food source:** Alderflies are almost exclusively predators, eating other aquatic insects.

**Interesting fact:** Adult alderflies are awkward fliers but good runners.



Aquatic earthworm



Horsehair worm

# Aquatic Worms

*Oligochaeta or Phylum: Nematomorpha*

**Identifying characteristics:** (Larva and adult) Include all wormlike organisms, segmented (aquatic earthworms) or non-segmented (horsehair worm); may look like a thin earthworm or like a coiled horsehair

**Habitat:** Most aquatic worms can be found in silty substrates and among the detritus of ponds, lakes, streams, and rivers.

**Food source:** Horsehair larvae are parasites of crickets, grasshoppers, and beetles. Adult horsehair worms do not ingest food. Other aquatic worms ingest detritus and other organic matter.

**Interesting fact:** Aquatic worms can live in water that is of poor quality and nearly oxygen-free.



# Black Fly

Diptera

**Identifying characteristics:** (Larva) Abdomen is wide or appears swollen like a bowling pin with a suction pad at the wide end

**Habitat:** Larvae generally attach by the end of their abdomens to rocks, woody debris, or vegetation in the currents of streams and rivers.

**Food source:** Black flies are primarily collectors, filtering food particles suspended in flowing water using their mouth brushes.

**Interesting fact:** Fly-fishing anglers tie flies that imitate the pupal and larval stages of black flies.



# Leech

*Hirudinea*

**Identifying characteristics:** (Adult) Flattened, has sucker on each end, more "muscular" than aquatic worms, many are patterned and brightly colored

**Habitat:** Leeches may be found on the substrate or attached to a host animal in a wide variety of aquatic habitats.

**Food source:** Predator species scavenge and prey on other invertebrates, such as aquatic insects, mollusks, and other freshwater worms. Parasitic species require a blood meal from a vertebrate host.

**Interesting fact:** Out of more than 60 species of leeches, only some feed on blood.



# Midge Fly

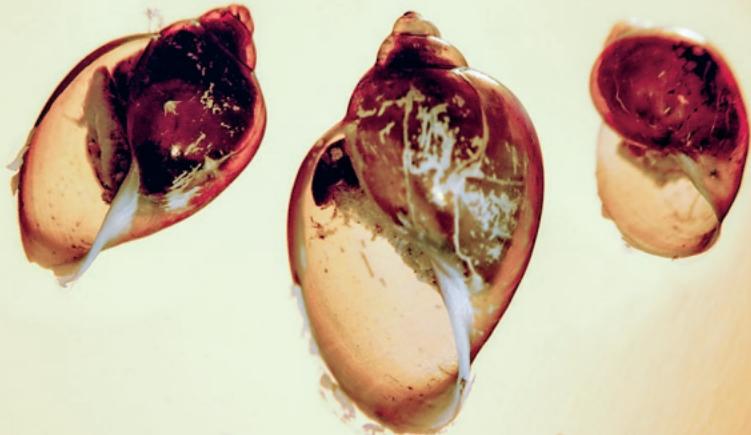
*Diptera*

**Identifying characteristics:** (Larva) Very small, less than  $\frac{1}{4}$  inch; segmented; has a distinct head; two tiny legs (prolegs) on first segment

**Habitat:** Midges can be found in virtually every type of aquatic habitat.

**Food source:** Midge flies eat everything from fine detritus and microorganisms to whole plant parts, decaying wood, and other aquatic insects.

**Interesting fact:** Like all diptera, adults possess only two (*di-*) wings (*ptera*), and are considered true flies.



# Pouch Snail

*Gastropoda*

**Identifying characteristics:** (Adult) With the spiral pointing up and the opening (aperture) facing up, the shell opens to the left. Do not count empty shells.

**Habitat:** Pouched snails are found in a variety of shallow water habitats and can survive in low-oxygen water. Some are known to burrow into soft substrates or detritus during dry periods or when shallow habitats become frozen solid.

**Food source:** Snails are primarily scrapers, feeding on encrusted growths of algae over which they creep.

**Interesting fact:** Some freshwater fish feed exclusively on snails.



## Other Snails

*Gastropoda*

**Identifying characteristics:** (Adult) Shell is flat, coiled and in one plane; not conelike in shape

**Habitat:** Snails are found in a variety of shallow-water habitats. Some are known to burrow into soft substrates or detritus during dry periods or when shallow habitats become frozen solid.

**Food source:** Snails are primarily scrapers, feeding on encrusted growths of algae over which they creep.

**Interesting fact:** Some freshwater fish feed exclusively on snails.

# Materials Needed to Sample Macroinvertebrates

- 3-foot by 3-foot kick net (500-micron mesh)
- Sorting pan and/or white ice cube trays
- Forceps and hand magnifier lens
- Squirt bottle
- *Macroinvertebrate Data Sheets*
- Macroinvertebrate identification resources

## Things to remember:

- Follow *Instructions for Biological Monitoring* on the back of your *Macroinvertebrate Data Sheet*.
- Take three net sets within your 300-foot monitoring site in three microhabitats (different water depths/velocities, rock sizes, leaf packs, emergent vegetation, etc.).
- If possible, take all three samples from riffles.
- Collect macroinvertebrates from undisturbed areas.
- Remember to work your way from downstream to upstream.
- Disturb the substrate thoroughly and get at least 3–6 inches deep.
- Stay safe!



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